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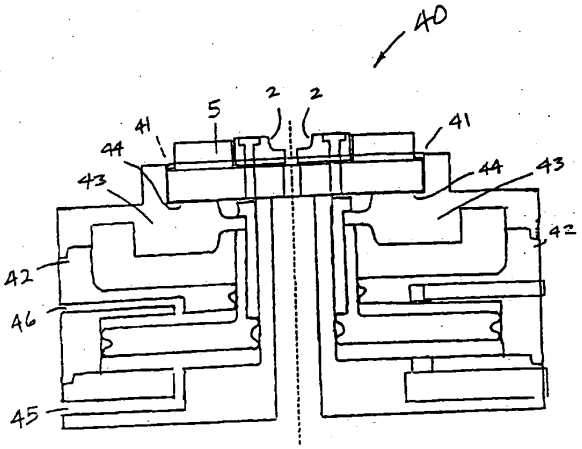
(54) Title: CRIMPING DIE EMPLOYING POWERED CHUCK



(57) Abstract: A forming die includes a base and at least two die segments. At least a first one of the die segments is moveably mounted to the base for shifting between closed and opened positions. The die segments together define a cavity having an opening when the first die segment is in the closed position. A punch is moveably mounted to the base for shifting between a retracted position and an extended position wherein the punch crimps a part positioned within the cavity. A powered actuator is connected to at least the first one of the die segments, and shifts the first die segment between the closed and opened positions such that a part positioned within the cavity can be removed after crimping by shifting of the first die segment to the open position. The forming die is particularly well-suited for crimping electrochemical cells.

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CRIMPING DIE EMPLOYING POWERED CHUCK

The present invention relates to crimping dies and the like, and in particular to a crimping die that utilizes a powered chuck and segmented die to release a formed part. Crimping dies of the present invention are useful for closing and sealing electrochemical cells, particularly small button cells.

Various types of metal forming dies have been used in the fabrication of a wide array of parts. One example is an electrochemical battery cell having a two piece cladding that is crimped together to form the finished battery cell. Known crimping methods utilize a one piece female die. A punch drives the two pieces of the cell into the female die segment, thereby deforming the outer edge of one of the cell pieces, and crimping the two sections together to form the electrochemical cell.

One problem encountered in such an arrangement is that the formed steel part will have some residual stress, causing the part to "spring" outwardly against the inner sidewalls of the female die segment. The friction generated between the part and the sidewalls of the female die segment can make removal of the formed cell difficult, leading to damage of the cell. Although lubricants may aid removal of the cell to some degree, such lubricants may lead to contamination of the cell. Even with lubrication it may not be possible to crimp the cell as tightly as desired and still permit removal of the cell without damage thereto, particularly for cells with thin sidewalls, such as button air cells.

A prior art segmented crimping die is shown in Figures 8 and 9A-9C. As shown in Figures 9A-9C, the prior art die includes a one-piece base support 101 having a bore 102 through which a lower punch 103 may be moved. Base plate 101 is generally fixed relative to the other parts. Base plate 101 further includes a recess 104 in which a one-piece crimp die 105 is disposed. Crimp die 105 also includes a central aperture through which lower punch 103 extends. The die further includes a tapered guide housing 106 disposed in fixed relation on base plate 101 and a top plate 107 mounted atop tapered

guide housing 106. Tapered guide housing 106 includes a centrally disposed tapered opening 109 for receiving four segmented dies 108a-108d. As shown in Figure 8, which is a top view of the four segmented dies, the four segmented dies together form annular side walls of the die and define a central opening through which an upper punch 111 and a battery 110 to be crimped may be moved. Top plate 107 also includes a centrally disposed hole of the same diameter for similarly allowing upper punch 111 and cell 110 to be moved therethrough. As shown, the four segmented dies are tapered and allowed to slide vertically along the tapered surface 109 of guide 106. In this matter, as the four segmented dies 108a-108d move vertically between the upper surface of the one-piece crimp die 105 and the lower surface of top plate 107, the four segmented dies move radially inward and outward to thereby increase/decrease the diameter of the centrally disposed aperture defined by the four segmented dies 108a-108d.

In operation, the die press is positioned with the four segmented dies 108a-108d in their lowermost position resting upon the upper surface of one-piece crimp die 105. A battery 110 is placed within aperture 112, and upper punch 111 is moved vertically downward to push the cell down against the curved portion of crimp die 105. Once the cell has been crimped, upper punch 111 is raised and lower punch 103 is moved vertically upward as shown in Figure 9B to push the crimped battery upward through aperture 112. Because of the close tolerances with aperture 112 relative to the outer dimensions of the battery, the four segmented dies 108a-108d tend to move upward as the battery is lifted by lower punch 103. As the four segmented dies 108a-108d are lifted, they will move radially outward at the same time until their upper surfaces abut the stops on top plate 107. With the four segmented dies in their uppermost position, the diameter of aperture 112 is sufficient to freely remove battery 110 from the die apparatus.

A problem exists, however, in that some of the segmented dies 108a-108d may at times become hung up, as shown in Figure 9C. Thus, when the next battery is inserted for crimping, the battery may become misaligned and a uniform crimping of the battery may not be obtained. A similar problem can occur during crimping, with one segment rising up independent of the other segments, due to the axial component of the radial stress on the

angled surface, and thereby limiting the amount of radial stress that can be applied during crimping.

When closing or sealing electrochemical cells, the above problems can result in damage to the cells, increased manufacturing costs, reduced shelf life, increased leakage and reduced discharge capacity after storage. This is particularly evident with button cells, which are small in size and mass. Reducing the crimping force applied during closing or sealing is not an effective solution, since the effectiveness of the cell seal may be sacrificed.

Accordingly, an apparatus and method for closing and sealing electrochemical cells that solves the above-identified processing problems and produces a better seal is desirable. We have now found that this may be accomplished by using a segment forming die, having at least one of the die segments opened and closed by a powered actuator, to crimp the open end of the cell container closed.

One aspect of the present invention is to provide a forming die including a base and at least two die segments. At least a first one of the die segments is moveably mounted to the base for shifting between closed and opened positions. The die segments together define a cavity having an opening when the first die segment is in the closed position. A punch is moveably mounted to the base for shifting between a retracted position and an extended position wherein the punch crimps a part positioned within the cavity. A powered actuator is connected to at least the first one of the die segments, and shifts the first die segment between the closed and opened positions such that a part positioned within the cavity can be removed after crimping by shifting of the first die segment to the open position.

Another aspect of the present invention is a forming die including a base and a pneumatic chuck. The pneumatic chuck has at least two powered jaws, each having a die segment mounted thereon, actuated by pneumatic pressure.

Yet another aspect of the present invention is a forming die including a base and a fluid actuated clamp.

In a preferred embodiment, the powered actuator comprises a flexible member, within a chamber, that moves in response to changes of pressure within the chamber to move the die segments.

The present invention will be further understood by reference to the drawings, in which:

Figure 1 is a partially fragmentary, front elevational view of a crimping die embodying the present invention, comprising an upper punch, and a lower segmented die utilizing an air chuck to release a crimped part;

Figure 2 is a cross-sectional view of the crimping die of Figure 1, taken along the line II-II;

Figure 3 is a cross-sectional view of the crimping die of Figure 1, taken along the line III-III;

Figure 4 is a top elevational view of the die segments;

Figure 5 is a partially fragmentary, front elevational view of the die segment of Figure 4, taken along the line IV-IV;

Figure 6 is a partially fragmentary, cross-sectional view illustrating the crimping of a part;

Figure 7 is a partially fragmentary, cross-sectional view illustrating the crimping of a part;

Figure 8 is a partially schematic top plan view of a prior art segmented crimping die;

Figure 9A is a partially fragmentary, cross-sectional view of the prior art crimping die of Figure 8 taken along the line IXA-IXA;

Figure 9B is a partially fragmentary, cross-sectional view of the prior art segment die of Figure 9A showing the segmented die in the open position;

Figure 9C is a partially fragmentary, cross-sectional view of the prior art crimping die of Figures 8 and 9 showing the upper punch in the raised position;

Figure 10 is a schematic drawing of a membrane type air chuck.

For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof shall relate to the invention as oriented in Figure 1. However, it is to be understood that the invention may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

The reference numeral 1 (Figure 1) generally designates a forming die embodying the present invention, which is particularly designed for forming electrochemical cells and the like, as by crimping. In the illustrated example, the forming die includes at least two die segments 2, at least a first one of which is movably mounted to a base or support structure 3 for shifting between closed and open positions. In the illustrated example, the die segments 2 are mounted to the jaws 5 of a pneumatic, or "air" chuck 4. The die segments 2 together define a die cavity 6 (see also Figures 4-7) having an opening 7 when the die segments 2 are in the closed position. A punch 8 is moveably mounted to the base structure between a retracted position and an extended position. In the extended position, the punch 8 forces a part, such as a miniature electrochemical cell 9, into the walls of the cavity 6 thereby crimping the cell. A powered actuator is connected to at least one of the die segments 2, and shifts the die segment 2 between the closed and opened positions, so that the electrochemical cell 9 positioned within the cavity 6 can be removed after crimping by shifting of the die segments 2 to the opened position.

With reference to Figures 1, 2 and 3, the base 3 generally includes a vertical plate 10 and upper and lower horizontal plates 11 and 12, respectively. A bearing plate 13 is slidably mounted to the vertical plate 10 by a pair of vertical rods 14 and pillow blocks 15. A punch holder assembly 16 is secured to the bearing plate 13 by conventional fasteners or

the like (not shown). The punch holder assembly 16 securely holds the punch 8 in alignment with the lower cavity 6 formed by the die segments 2. A rod 17 is secured to the punch holder assembly 16. Rod 17 is attached to an electric servo, hydraulic driver, or other powered actuator (not shown) having sufficient force to form the part 9 in the die cavity 6.

The electrochemical cells 9 are transferred to the die and crimped cells 9 are removed from the die after the forming operation. Any suitable mechanism, such as an index wheel, can be used for this purpose.

The pneumatic chuck 4 is securely supported on a horizontal plate 19 of the base 3 by a support assembly 18. A lower punch 20 is positioned below the pneumatic chuck 4. Punch 20 is slidably supported in alignment with the cavity 6 by a punch holder assembly 21. A spring 22 is supported by a stop block 23, and biases the lower punch 20 upwardly into the die cavity 6. An adjustable stop 24 is threadably received within the stop block 23, and limits the downward travel of the lower punch 20. As discussed in more detail below, spring 22 is relatively light weight, and lifts the formed electrochemical cell upwardly upon shifting of the die segments 2 to the opened, released position. With further reference to Figures 4 and 5, each die segment 2 is made of a suitable hardened tool steel, and includes a plurality of openings 25 to secure the die segment 2 to the jaws 5 of the pneumatic chuck 4. Each die segment 2 includes a sidewall 26 that is radiused, such that the die segments 2 together form a cylindrical die cavity 6. The upper portion 28 of the sidewall 26 is generally parallel to a vertical axis, and the lower portion 29 of the sidewall curves inwardly at radius 27.

With further reference to Figures 6 and 7, a standard electrochemical cell 9 includes a first metal casing portion 30 (also known as the "can") having a shape similar to an inverted cup. The electrochemical cell 9 also includes a second metal casing part 31 (also known as the "anode cup") that is also generally cup shaped. The part 31 has a slightly smaller diameter than part 30, such that part 31 fits inside part 30. A seal 34 fits between parts 30 and 31 and prevents electrical conduction between parts 30 and 31. The

internal components 32 of the cell 9 are sandwiched between the first and second parts 30 and 31. During operation, an uncrimped electrochemical cell 9 is shifted into position at the upper portion of the die cavity 6. The electrochemical cell 9 is placed on the lower punch 20, which is in its uppermost position due to the upward bias of spring 22. The die segments are shifted into the extended, or closed, position by actuation of the pneumatic chuck 4. The upper punch 8 is then shifted downwardly by actuation of the electrochemical servo (not shown). As the upper punch 8 shifts downwardly, the uncrimped electrochemical cell 9 is pushed downwardly within the die cavity 6 until the electrochemical cell 9 is crimped on the radiused portion 27 of the die cavity 6. The die segments 2 are then shifted outwardly by actuation of the pneumatic chuck 4 into the uncrimped, or open position. The powered ram and upper punch 8 are then shifted upwardly, with the lower punch 20 holding the crimped cell 9 against the upper punch 8. The die segments 2 are then shifted into the extended, or closed, position; the finished, crimped cell 9 is removed; and a new, uncrimped cell 9 is brought into the die. Alternatively, the die segments 2 could be in the open position when cell 9 is pushed into the die cavity and then closed to crimp the cell. However, this may leave undesirable marks corresponding to the parting lines of die segments 2, on the crimped surface of cell

In the illustrated example described above, the die segments 2 are mounted to a pneumatic chuck 4. A preferred pneumatic chuck is a five-inch diaphragm chuck available from Schunk Intec Precision Instrument Corporation of Island Park, New York. A membrane chuck 40 is shown schematically in Figure 10. Peripheral portions 41 of the jaws 5 are connected to a peripheral base 42 via a flexible diaphragm 43. When compressed air is introduced into air passageway 45, a resulting force is applied to the lower side 44 of the jaws by the chuck. This causes jaws 5 and attached die segments 2 to pivot upward and outward to the open position. When compressed air is introduced into air passageway 46, the jaws 5 are moved to the closed position. Other pneumatic chucks may also be used. For example, a six-inch air chuck, model no. 6-120NR-3, available from MicroCentric Corporation of Plainview, New York, may be used. As illustrated in Figure 3, jaws 5 of this type of chuck are mechanically driven radially inward and outward, to the closed and

opened positions respectively. It is anticipated that other types of powered actuators couid be connected to one or more of the die segments 2 to permit shifting of the die segments for release of the crimped cell. For example, the die segments 2 could be movably mounted to the base by a conventional slide arrangement, with an electrochemical, pneumatic, or other powered actuator connected to the movable die segment(s) for shifting between closed and open positions. Die segments 2 may be mounted to jaws 5 by any suitable means, such as bolting, screwing, welding, clamping, pinning, gluing and so on; or die segments 2 may be an integral part of jaws 5. It is also anticipated that other types of flexible members could be used instead of a flexible diaphragm. For example, each die segment could be biased by one or more separate flexible members. Because die segments 2 are fastened to jaws 5, undesirable vertical movement of die segments 2 is prevented.

The forming die of the present invention facilitates removal of the finished electrochemical cell, without damage of the cell, or contamination by lubricants or the like. Furthermore, the diameter of the cylindrical die cavity 6 can be made smaller relative to the part being formed, thereby permitting a tighter crimp of the electrochemical cell 9, yet still permitting removal of the crimped cell without damage.

In the foregoing description, it will be readily appreciated by those skilled in the art that modifications may be made to the invention without departing from the concepts disclosed herein. Such modifications are to be considered as included in the following claims, unless these claims by their language expressly state otherwise.

CLAIMS:

1. A forming die, comprising:

a base;

at least two die segments, at least a first one of which is movably mounted to said base for shifting between closed and open positions, said die segments together defining a cavity having an opening when said first die segment is in said closed position;

a punch movably mounted to said base for shifting between a retracted position and an extended position wherein said punch pushes against a part positioned within said cavity, thereby causing the part to be crimped; and

a powered actuator connected to at least the first one of said die segments and shifting said first die segment between said closed and open positions such that a part positioned within said cavity can be removed after crimping by shifting of the first die segment to the open position.

2. A forming die according to claim 1, wherein said powered actuator comprises a pneumatic chuck having at least two powered jaws actuated by pneumatic pressure, each of said powered jaws having one of said die segments mounted thereon.

3. A forming die according to claim 2, wherein said pneumatic chuck is a three-jaw chuck.

4. A forming die according to any preceding claim, wherein said powered actuator includes a flexible member and a chamber on a first side of said member, said die segments mounted on a second side of said member, said member flexing upon pressurization of said chamber to shift said die segments to said open position.

5. A forming die according to claim 1, wherein said powered actuator comprises a fluid actuated clamp.

6. A forming die according to claim 5, wherein said fluid actuated clamp includes 3 jaws, said die pieces mounted on said jaws.

7. A forming die according to claim 5, wherein said fluid actuated clamp further includes a chamber and a flexible member communicating within said chamber, such that said clamp moves in response to changes of pressure within said chamber.

8. A forming die according to claim 4 or claim 7, wherein said flexible member is configured to rotate said die pieces upon pressurization of said chamber.

9. A forming die according to claim 4 or claim 7, wherein said flexible member is a diaphragm.

10. A forming die according to claim 1, wherein said die cavity has a sidewall surface defining a generally cylindrical shape.

11. A forming die according to claim 10, wherein said generally cylindrical shape comprises first and second open ends and an inwardly tapering portion adjacent said second open end.

12. A forming die according to claim 11, wherein said punch comprises a first punch and said forming die has a second punch.

13. A forming die according to claim 12, wherein said first punch enters said first open end of said die cavity to form a part positioned therein and said second punch shifts into said second open end of said die cavity to eject a formed part.

14. A forming die according to claim 12 or claim 13, wherein said power actuator is connected to said first punch for shifting said first punch between extended and retracted positions.

15. A forming die according to claim 2 or claim 6, wherein said jaws are movably interconnected.

16. A method of sealing the casing of an electrochemical cell, comprising the steps:

(a) assembling a first metal casing portion and a second metal casing portion inside an open end of said first metal casing portion, with a seal disposed between said first and second metal casing portions; and

(b) crimping said first metal casing portion against said seal and said second metal casing portion with a forming die according to any preceding claim.

17. A method of sealing the casing of an electrochemical cell according to claim 16, wherein said first metal casing portion is a can and said second metal casing portion is a cup.

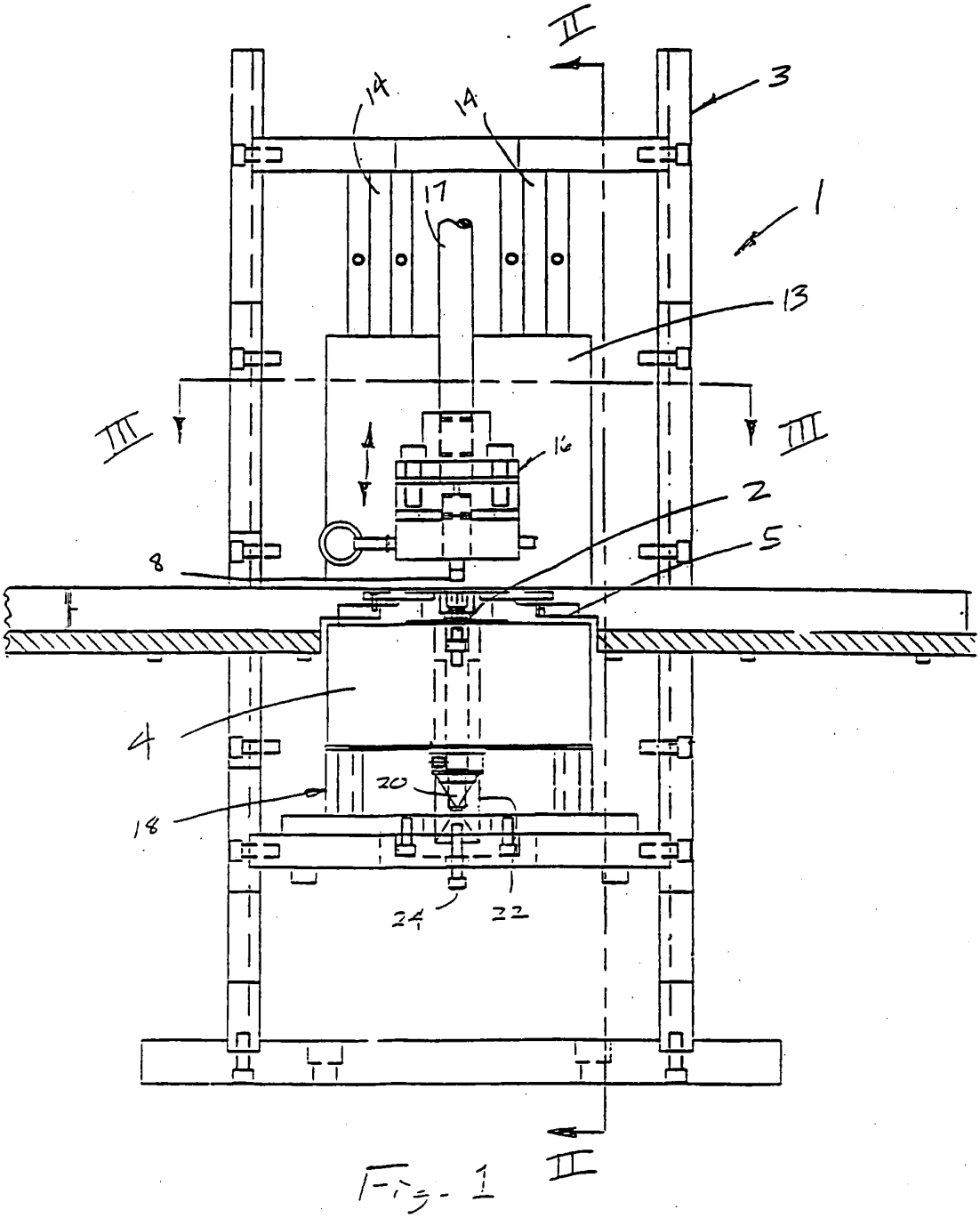

Fig. 1

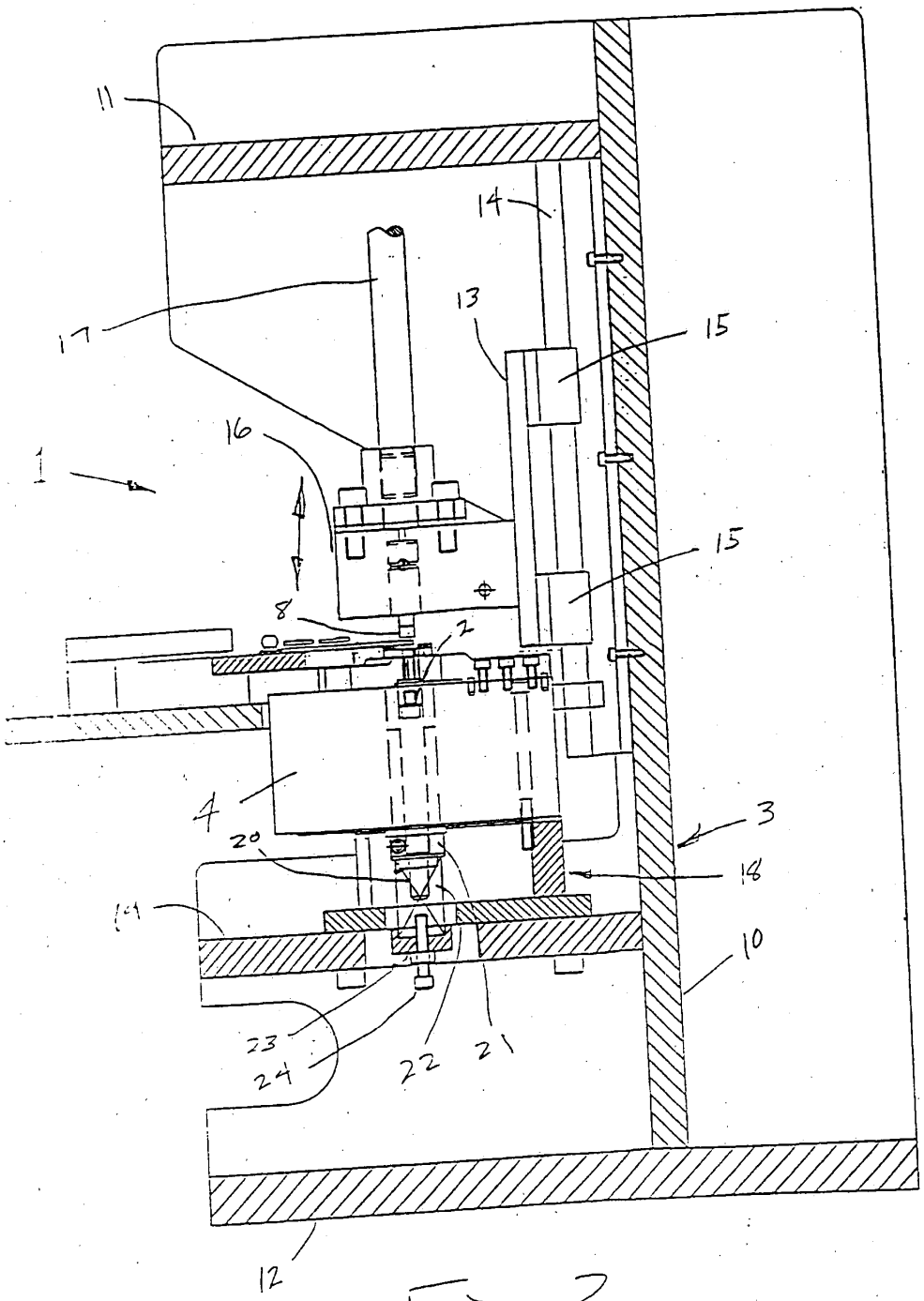

Fig. 2

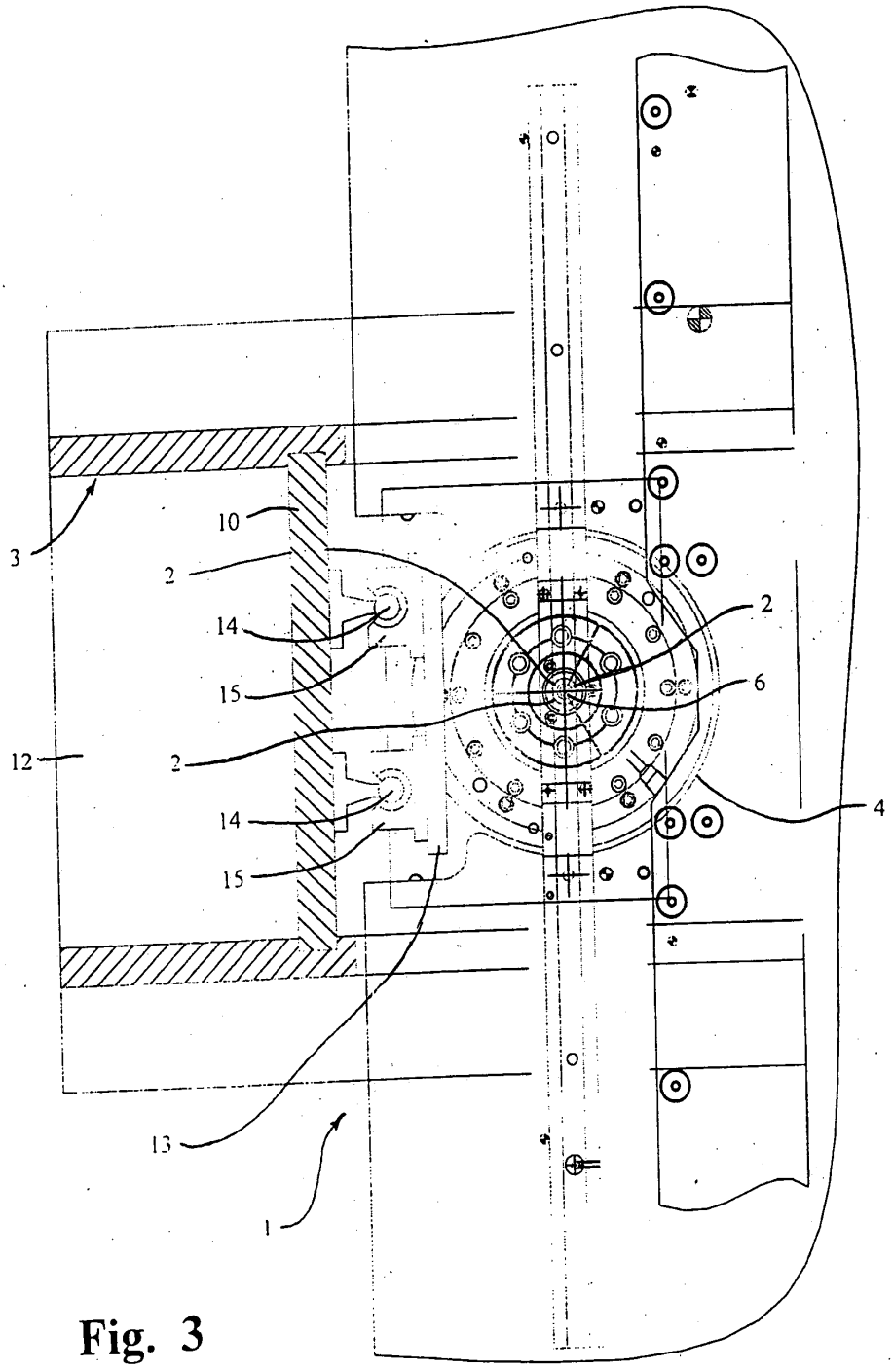

Fig. 3

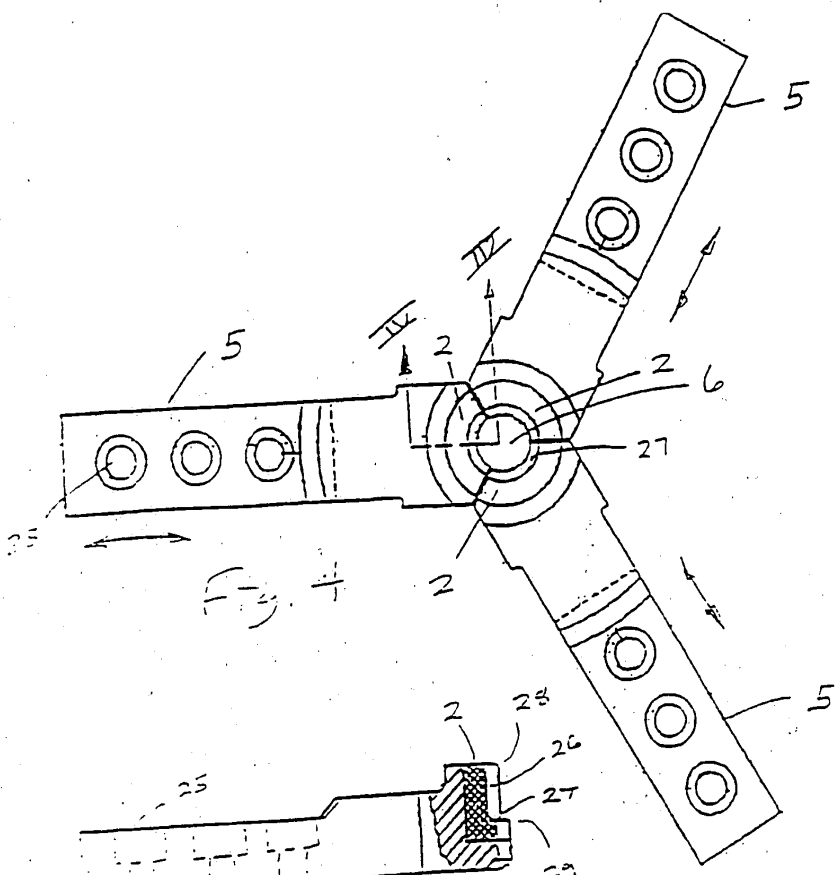

Fig. 4

Fig 5

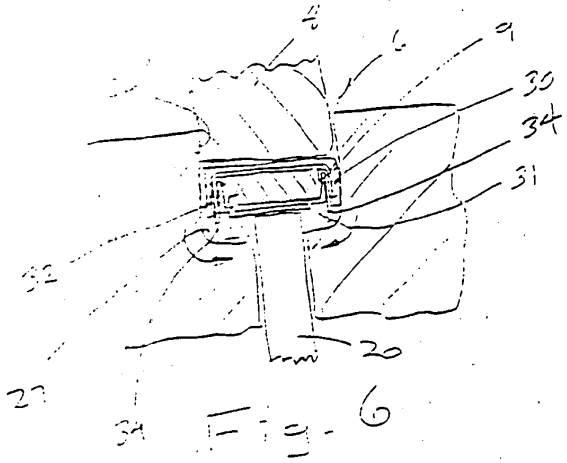

Fig. 6

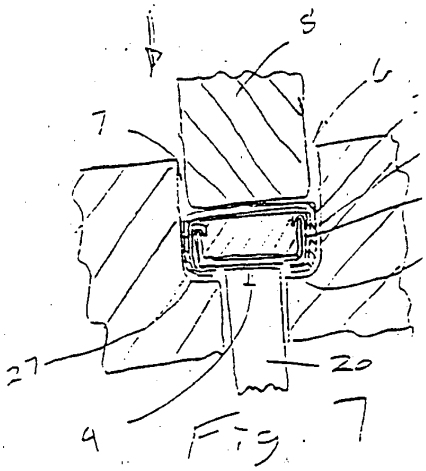

Fig. 7

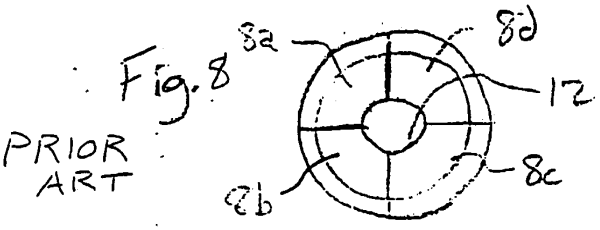

Fig. 8
PRIOR ART

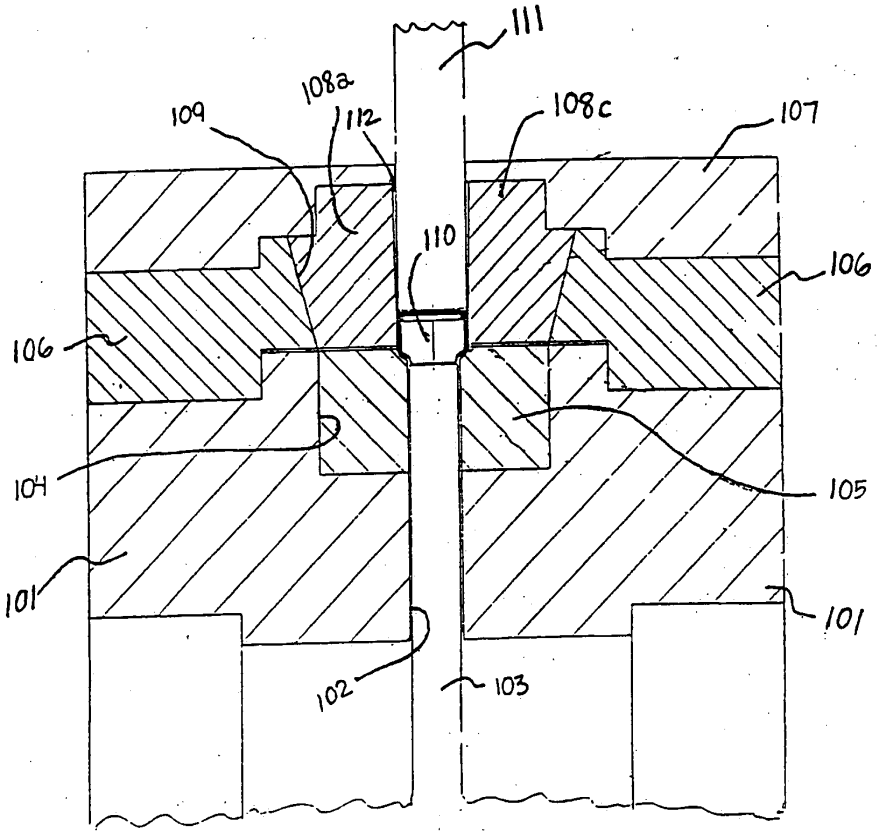

Fig. 9A
PRIOR ART

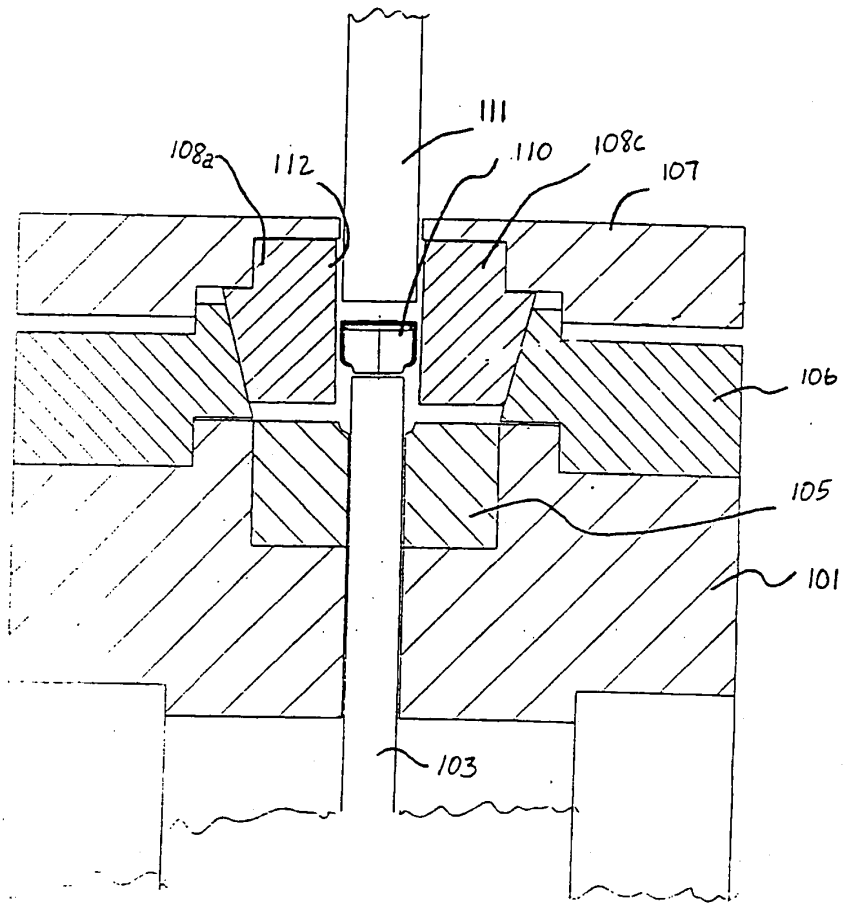

Fig. 9B
PRIOR ART

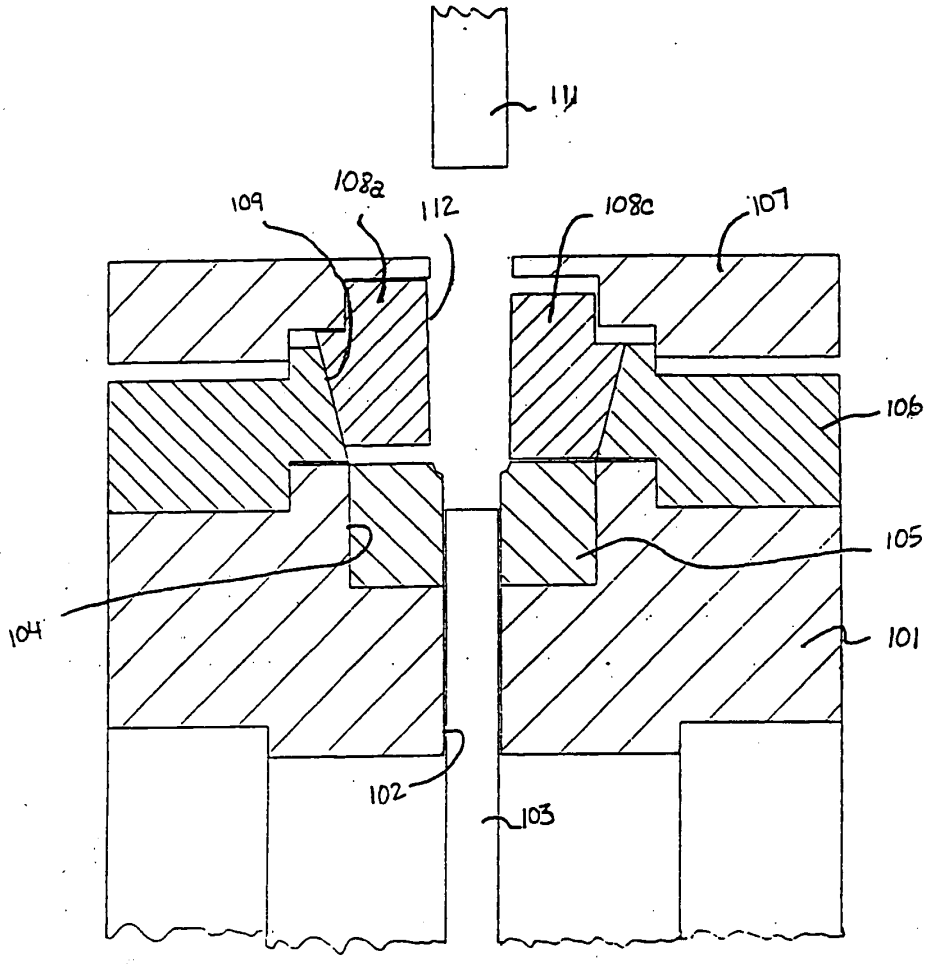

Fig. 9C

PRIOR ART

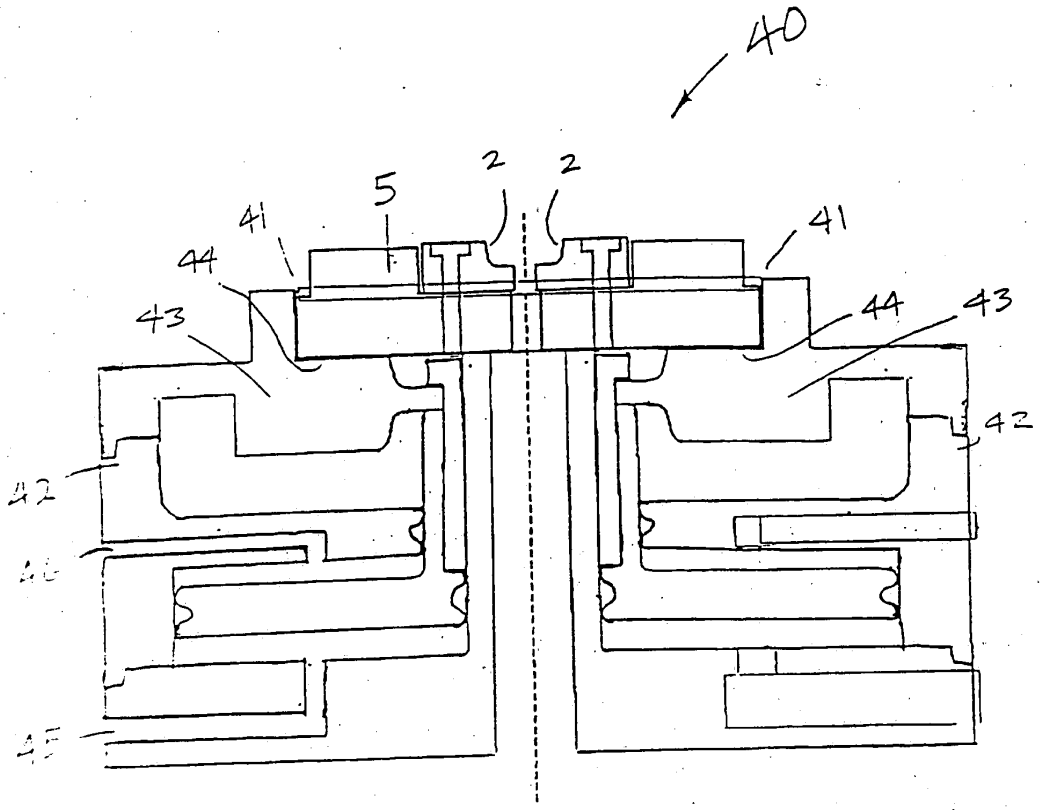

Fig. 10

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/02915

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B23P11/00 B21D39/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B23P H01M B21D B21J B25B B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 3 706 123 A (WHITLEDGE JON KEYES) 19 December 1972 (1972-12-19) the whole document	1,5,10, 14 2,11-13, 15-17 3,4,6-9
Y	US 4 139 207 A (GRIMES LARRY E) 13 February 1979 (1979-02-13) abstract	2,15
Y	PATENT ABSTRACTS OF JAPAN vol. 015, no. 434 (E-1129), 6 November 1991 (1991-11-06) & JP 03 182046 A (SEIKO ELECTRONIC COMPONENTS LTD), 8 August 1991 (1991-08-08) abstract	11-13

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
26 April 2001	07/05/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. Fax: (+31-70) 340-3016	Watson, S

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Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACTS OF JAPAN vol. 015, no. 401 (E-1121), 11 October 1991 (1991-10-11) & JP 03 163750 A (TOSHIBA BATTERY CO LTD), 15 July 1991 (1991-07-15) abstract	16,17
A	US 3 837 206 A (MICHALKO I) 24 September 1974 (1974-09-24) the whole document	1-17
A	US 4 034 593 A (PATEL HIRALAL V) 12 July 1977 (1977-07-12) the whole document	1-15
A	PATENT ABSTRACTS OF JAPAN vol. 004, no. 091 (E-017), 28 June 1980 (1980-06-28) & JP 55 056362 A (MATSUSHITA ELECTRIC IND CO LTD), 25 April 1980 (1980-04-25) abstract	16,17

INTERNATIONAL SEARCH REPORT

...rmation on patent family members

Inte...nal Application No
PCT/US 01/02915

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3706123 A	19-12-1972	BE 777155 A	17-04-1972
		CA 964442 A	18-03-1975
		JP 54013868 B	02-06-1979
US 4139207 A	13-02-1979	NONE	
JP 03182046 A	08-08-1991	NONE	
JP 03163750 A	15-07-1991	NONE	
US 3837206 A	24-09-1974	NONE	
US 4034593 A	12-07-1977	AU 517000 B	02-07-1981
		AU 2225277 A	24-08-1978
		BE 853166 A	01-08-1977
		CA 1068082 A	18-12-1979
		DE 2713243 A	27-10-1977
		ES 457561 A	16-03-1978
		FR 2347121 A	04-11-1977
		GB 1552108 A	05-09-1979
		GB 1552109 A	05-09-1979
		IT 1082744 B	21-05-1985
		JP 52124213 A	19-10-1977
		MX 144245 A	17-09-1981
JP 55056362 A	25-04-1980	NONE	